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When these forms occur as the answers of problems, they have, in general, perfectly definite values, and these definite values must be found. But when these forms stand apart from the consideration of problems, they are perfectly meaningless,

Drury College, September 14, 1896.

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ARITHMETIC.

Conducted by **B. F. FINKEL**, Springfield, Mo. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

60. Proposed by J. K. ELLWOOD, A. M., Principal of Colfax School, Pittsburg, Pennsylvania.

A pipe 1 foot long and 27-32 inch in diameter has a half-inch orifice and weighs 1¾ pounds. What is the diameter of a pipe the same length and orifice, but weighing 41 ounces?

I. Solution by F. M. McGAW, A. M., Professor of Mathematics, Bordentown Military Institute, Bordentown, New Jersey.

Let V_1 = volume of "solid" pipe.

Let V_2 = volume of bore.

Then $V_1 - V_2$ = volume of metal $=\pi(\frac{1419}{1024})$ cubic inches.

Since weights are proportional to volumes, $\pi(\frac{1419}{1024}) : V_3 = 28 : 41$, where V_3 = volume of required size of pipe.

Add to this volume of bore $=V_2$, and we have,

$$V_3 + V_2 = V_4 = \text{new "solid" pipe} = \pi(\tfrac{79683}{28672}) \text{ cubic inches.}$$

$$\text{Hence } R = \{\pi(\tfrac{79683}{28672}) \div \pi.12\}^{\frac{1}{2}} = \tfrac{431.192}{896} \text{ and } D = .9625 \text{ inches.}$$

II. Solution by EDWARD R. ROBBINS, Master in Mathematics and Physics, Lawrenceville School, Lawrenceville, New Jersey.

The volumes of the two pipes will have the same ratio as their weights.

$$\text{Hence, } \frac{\pi l\left[\left(\frac{D}{2}\right)^2 - \left(\frac{d}{2}\right)^2\right]}{\pi l\left[\left(\frac{D'}{2}\right)^2 - \left(\frac{d}{2}\right)^2\right]} = \frac{w}{w'}; \text{ or } \frac{D^2 - d^2}{D'^2 - d^2} = \frac{w}{w'},$$

where the D's represent the diameters of the pipes, and d the common diameter of their *orifices*. From this

$$D'=\sqrt{\frac{w'D^2-w'd^2+wd^2}{w}}=\sqrt{\frac{w'}{w}(D^2-d^2)+d^2}.$$

$$=\sqrt{\tfrac{41}{28}[(\tfrac{27}{32})^2-(\tfrac{1}{2})^2]+\tfrac{1}{4}}=\sqrt{\tfrac{26561}{28672}}=.96248+\text{ inches.}$$

Also solved by *G. B. M. ZERR*, *H. C. WILKES*, and *J. SCHEFFER*.

61. **Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pennsylvania.**

Insured my store for a/bth$=\frac{3}{4}$th of its value, at $r=1\frac{1}{4}\%$; but soon afterward the store was burned down, and my loss over the insurance was $\$L=\$4150$. What was the value of my store?

I. Solution by HON. JOSIAH H. DRUMMOND, LL. D., Portland, Maine.

Construing the terms of this question as they are used in legal and insurance circles the solution is $\$4,150\times4=\$16,600$.

But the proposer evidently intends to reckon the premium paid as a part of the "loss."

Then for every \$4.00 of value \$3.00 was insured at a cost of 3.75 cents, leaving \$1.0375 of loss.

Hence 1.0375 : 4 :: 4150 : 16,000.

II. Solution by J. SCHEFFER, A. M., Hagerstown, Maryland.

The value of the policy is $\frac{a}{b}\cdot\frac{r}{100}x$, x representing the value of the store.

We have, therefore, obviously,

$$x\left[1-\frac{a}{b}\left(1-\frac{r}{100}\right)\right]=L,\ \therefore x=L\div\left[1-\frac{a}{b}\left(1-\frac{r}{100}\right)\right].$$

Substituting numerical value, we find $x=\$16,000$.

III. Solution by G. B. M. ZERR, A. M., Ph. D., Texarkana, Arkansas-Texas; P. S. BERG, Larimore, North Dakota; and A. P. READ, A. M., Clarence, Missouri.

Let s=value of store.

$$\text{Then } s-\frac{as}{b}=\left(\frac{b-a}{b}\right)s;\ \frac{r}{100}\times\frac{as}{b}=\frac{ars}{100b}.\ \therefore\left(\frac{b-a}{b}+\frac{ar}{100b}\right)s=L.$$

$$\therefore s=\frac{100bL}{100b-100a+ar}=\frac{400(4150)}{100+\frac{15}{4}}=\$16,000.$$

Also solved by *EDWARD R. ROBBINS*, and *F. M. McGAW*.